EPA Superfund Program Region 10
Proposed Plan

White King/Lucky Lass Site
Lakeview, Oregon October 1, 1999

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan identifies the Preferred Alternative for addressing the contaminated soils at the White King/Lucky Lass Site and provides the rationale for this preference. In addition, this Plan includes summaries of other cleanup alternatives evaluated for this site. This document is issued by the U.S. Environmental Protection Agency (EPA), the lead agency for site activities, and the U.S. Department of Agriculture - Forest Service (Forest Service), the federal support agency. The Oregon Office of Energy (OOE) and Oregon Department of Environmental Quality (ODEQ) are the state support agencies. EPA, in consultation with the Forest Service and state support agencies, will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. EPA, in consultation with the Forest Service and state support agencies, may modify the Preferred Alternative or select another response action presented in the Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all alternatives presented in this Proposed Plan. The section titled "Community Participation" provides details about the public participation process.

The preferred cleanup alternative identified in this Proposed Plan calls for the following; consolidation and capping of two stockpiles at the White King Mine area, neutralization of the White King pond, and removal of some soils from the Lucky Lass Stockpile or adjacent area to be consolidated with the White King Stockpile. In addition to these actions, institutional controls would be used to prevent future residential use of the site and restrict

Dates to Remember:

MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:
October 1-31, 1999

U.S. EPA will accept written comments on the Proposed Plan during the public comment period. Comments should be sent to

Bill Adams,Project Manager
U.S. EPA
1200 Sixth Avenue
Mail Stop ECL-111
Seattle, Washington 98101
(206) 553-2806 or 1-800-424-4372

PUBLIC MEETING:
Oct 14, 1999
7:00pm to 9:00pm

U.S. EPA will hold a public meeting to explain the Proposed Plan and the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at :
Lake County Senior Community Center
11 “G” Street
Lakeview, Oregon

For more information, see the Remedial Investigation/Feasibility Study reports at the following locations:

Lakeview Ranger District
Lakeview, OR 97630
Contact: Janine Cannon (541) 947-3334

Lake County Library
County Courthouse
513 Center St.
Lakeview, OR 97630
Phone: (541) 947-6019

Other sources of information for this site include the Oregon Department of Environmental Quality (ODEQ), Oregon Office of Energy (OOE), and the Forest Service, whose representatives have worked closely with EPA to oversee the RI/FS work access to the White King stockpile. Because hazardous substances would remain on site, long-term operation and maintenance (O&M)and EPA five-year reviews would be required. The cleanup of the Mine site is being conducted pursuant to the Comprehensive Environmental Response Compensation Liability Act (CERCLA), also known as Superfund.

EPA and the Forest Service are issuing this Proposed Plan as part of the public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation and Feasibility Study Reports (RI/FS) and other documents contained in the Administrative Record file for this site. EPA, the Forest Service, and state support agencies encourage the public to review these documents to gain a more comprehensive understanding of the site and Superfund activities that have been conducted at the site.

SITE BACKGROUND

The White King/Lucky Lass mine site is a former uranium mining area located in South-central Oregon, northwest of Lakeview. Lakeview Mining Company began mining the site in 1955. Initial mining at White King was underground via mine shafts until 1959. In 1959, open-pit mining techniques were used and continued until active mining stopped around 1965. Mining techniques resulted in the stockpiling of overburden material in the current locations and the creation of the pit where ore was extracted. Mining at Lucky Lass was conducted via open-pit mining techniques. Through a series of mergers, Kerr-McGee Corporation acquired Lakeview Mining and became a potentially responsible party (PRP)under CERCLA. Other individuals or entities involved at the site may also be PRPs.

In 1989, the Forest Service began considering action on the mine pits and the piles of overburden. In August 1991, the Forest Service issued a draft report titled, "Draft Environmental Impact Statement Remedial Investigation & Feasibility Study for the Cleanup and Rehabilitation of the White King and Lucky Lass Uranium Mines." This report was written by the Forest Service to evaluate proposed remediation alternatives at the Mines site. This report was revised in 1994 to included expanded discussions, more detailed descriptions, and edits for clarification. Subsequent to this report EPA listed the Mines Site on the National Priorities List (NPL) on April 25, 1995. Upon review of the 1994 DEIS-RI/FS Report, EPA determined that further investigation and alternative analysis was needed to support a remedial action decision. On April 24, 1995, Kerr-McGee Corporation signed an Administrative Order on Consent with EPA, the Forest Service, OOE, and ODEQ to conduct a RI/FS. The RI/FS was completed in August 1999.

SITE CHARACTERISTICS

The site is located on the Fremont National Forest, which is managed by the Forest Service, and also on private lands owned by Fremont Lumber and several individuals. The White King and the Lucky Lass Mines are located within 1 mile of each other. Figures at the end of this document show the location and major features at this site.

Major features at the White King Mine include the White King pond (25 acres), the protore[1] stockpile (17 acres), the overburden stockpile (24 acres), and Augur Creek which is adjacent to the two stockpiles. The stockpiles contain soil and mineralized rock that were removed from the mine pit to facilitate mining of ore. A grassy meadow and wetland area separate the two piles. The pond is an excavation pit created as a result of past mining operations and has been filled with water since. The deepest part of the pond is approximately 70 feet. Until recent neutralization efforts conducted as part of a pilot study, the pond water had been acidic with a pH of approximately 3-4 (a pH

[1] Protore is a mining term for low-grade mineralized materials surrounding an ore. This term was originally used to describe one of the stockpiles at the mine site. The results of subsequent investigations seem to indicate that both stockpiles consist of overburden (material removed to reach the ore), however the original terminology was retained to be consistent with previous reports.

of seven is considered neutral).

The features at the Lucky Lass Mine include a water-filled excavation pit (5 acres), an overburden stockpile (14 acres), and an adjacent meadow. The deepest part of this pond is also approximately 70 feet.

The Mines site is situated in a remote area. The closest residences and drinking water wells are located more than ten miles from the site. Occasional use of the area in the vicinity of the Mines site is primarily recreational, including hunting, snowmobiling, and wood-cutting. The site is at an elevation between 5,700 and 6,000 feet above mean sea level. The ground is snow-covered for approximately half the year. Access to the site is currently restricted by fences and locked gates.

What are the primary "Contaminants of Concern"?

Arsenic: Arsenic is a naturally occurring element in the earth's crust and is widely distributed in the environment. Natural mineral deposits in some geographic areas contain large quantities of arsenic, and this may result in elevated levels of arsenic in water or soil. Arsenic in soil is of particular concern for small children who swallow small amounts of soil while playing. Arsenic has been recognized as a human poison since ancient times, and large doses can produce death. Lower levels of exposure can produce injury in a number of different body tissues or systems such as the skin, blood vessels, liver and kidneys, and nerves. In addition arsenic has been reported to increase the risk of cancer inside the body.

Radionuclides: Radionuclides are naturally occurring radioactive isotopes of radium metal. As with arsenic natural mineral deposits contain larger quantities of radioactive materials. During the decay of radionuclides alpha, beta, and gramma radiations are released. Gamma radiation is of particular concern since it can go all the way through the human body. Radium and its isotopes, such as Radium-226, have been shown to cause adverse health effects such as anemia, cataracts, fractured teeth, cancer and death. Although there is some uncertainty as to how much exposure to radionuclides increases your chances of developing a harmful health effect, the greater the total amount of your exposure to radium, the more likely your are to develop one of these harmful effects.

From 1995 to 1999, Kerr McKee conducted a RI/FS under EPA and support agencies' oversight. The RI/FS identified types, quantities, and locations of contaminants and developed ways to address the contamination problems. The RI indicated that:

Soil

- The stockpiles at White King contain elevated activities and concentrations of radionuclides and arsenic. Based on a limited number of borings the concentrations and activities tend to decrease with depth. This seems to indicate that the highest levels of contamination are toward the surface and negligible migration of contaminants has occurred to date. One exception to this is a location below the protore stockpile. Contaminants beneath the stockpile in this area are elevated but may be related to natural mineralization rather than contaminant migration. Generally off-pile soils do not exceed EPA preliminary remediation goals (PRG)[2] for radium-226 and arsenic.

- At the Lucky Lass mine, the concentrations and activities of radionuclides and arsenic in the stockpile are less than at White King. However, there are approximately 3,000 cubic yards of material on the surface of the stockpile or in the adjacent meadow which exceed PRGs.

Surface Water

- Overall surface water concentrations, including Augur Creek, seeps, and pond samples, do not exceed the Federal ambient water quality criterion for arsenic or Oregon State Water Quality Standards [340.41].

- The White King pond historically has had low pH values (3 -4), particularly at depth, as a result of past mining operations. This seems to indicate that the abandoned mine shaft may be a major source of

[2] PRGs are developed during the RI/FS and are based on ARARs and other readily available information, such as concentrations associated with a 10^{-6} cancer risk or a hazard quotient equal to one for non-carcinogens calculated from EPA toxicity information.

the acidity to the pond. Due to this low pH, the pond has been relatively sterile and has not supported a diverse aquatic community, as would otherwise be expected if the pond were not acidic. In the fall of 1998, Kerr-McGee added lime to the White King pond to neutralize the pH as part of a CERCLA pilot study. The most recent pond data (July 1999) indicate that the pH ranges from 6.5 at the surface to 4.5 in the deepest part of the pond. These data seem to indicate that the pond can be neutralized but periodic addition of lime will be necessary to maintain a consistent neutral pH, particularly at lower depths.

Sediment

- Arsenic and manganese were elevated within portions of Augur Creek and the White King Pond. The sediments in the White King pond exceed generally accepted values shown to cause adverse effects for arsenic.

Groundwater

- Radionuclide and arsenic groundwater concentrations were elevated in the shallow water beneath the stockpiles and significantly lower outside the footprint of the stockpiles. The pH values in all wells were within the normal groundwater ranges, except for the stockpile wells. Groundwater concentrations in the vicinity of the White King Mine are slightly higher than groundwater at Lucky Lass.

- The groundwater data indicates that there is limited migration of contaminants from the stockpiles and there appears to be limited potential for the stockpiles to generate acid drainage.

SCOPE AND ROLE OF RESPONSE ACTION

Three interrelated remedial actions will be taken at this site for the White King Stockpiles, White King Pond, and Lucky Lass soils. These actions will be the final actions for the site. The overall strategy is to contain the contaminants on site and address the acidic water in the White King Pond. Because the site does not have a "principal threat" waste as defined in the NCP, the expectation that EPA will use treatment to address any "principal threats" posed at a site wherever practicable is not applicable.

SUMMARY OF SITE RISKS

As part of the RI/FS, potential risks to human health and the environment posed by radionuclides and metals were assessed at the site. This analysis is commonly referred to as the **baseline risk assessment**, consisting of an evaluation of human health risks and ecological risks assuming no remedial action is taken at the site. These risk assessments are documented in the RI reports.

Human Health Risks

Human health risks were evaluated for several possible exposure pathways, including: ingestion and inhalation of contaminated soil, ingestion of contaminated groundwater, and exposure to elevated levels of radionuclides.

Considering the current and foreseeable land use, and EPA guidance, the following exposure scenarios were evaluated:

! Current/Future worker exposure
! Future residential exposure (adult and child)
! Current/Future Recreational Exposure (adult and child)

The following are the sources and pathways of potential exposure evaluated in the risk assessment:

Stockpile Materials/Soil/Sediment:

- Incidental ingestion of soil and stockpile materials
- Incidental ingestion of sediment
- External exposure to radiation from

radionuclides in soil

Air

- Inhalation of particulates
- Inhalation of radon from soil (for potential future residents)

Water

- Incidental ingestion of surface and pond water
- Ingestion of groundwater (potential future residents)
- Inhalation of radon gas from groundwater (potential future residents)

The most significant human health risks identified for the site are presented below:

- Radionuclide cancer risk estimates for a current White King Mine worker exposed to soil were 3 in 10,000 due to exposure to external radiation which exceeds acceptable risk. Risks for a future worker would be acceptable (under the future scenario values for surface and subsurface soils were combined to derive an exposure estimate, while the current scenario used only surface soil data).

- For the future recreational user exposed to soils at White King, chemical cancer risks were 5 in 10,000 which exceeds acceptable risk. This is predominately due to arsenic in soil. Estimates for both the current and future child recreational users (hazard index ranging from 4 and 10 respectively) were above the estimated hazard index of one, indicating that there is a potential for adverse health effects. The potential for future chemical cancer risk and for current and future adverse noncancer health effects to a child are primarily associated with incidental ingestion of arsenic in soil.

- For the potential future resident at White King Mine, the chemical and radionuclide cancer risks ranged from 5 in 10 to 2 in 100 which exceed EPA's acceptable risk management range; thus, chemical and radionuclide cancer risks for a potential future resident residing on the White King protore pile, overburden pile, and off-pile area would be unacceptable. The highest chemical and radionuclide cancer risks are associated with ingestion of soil and shallow bedrock groundwater. There is also potential risk associated with exposure to arsenic, radium-226/228, and radon in soil at the protore pile; arsenic and radium 226/228 in the overburden pile; and arsenic in the off-pile area. There is also a potential for adverse noncarcinogenic effects to potential future residents (hazard index ranging from 2 to 5,000) residing at the White King Mine, which is primarily associated with the ingestion of arsenic and manganese in shallow bedrock groundwater.

- For the potential future resident at Lucky Lass Mine, the chemical and radionuclide cancer risks ranged from 5 in 10,000 to 1 in 1,000 which exceed acceptable risk; thus, chemical and radionuclide cancer risks for a potential future resident residing on the Lucky Lass overburden pile and off-pile area may be unacceptable. The highest chemical cancer risks are associated with ingestion of groundwater. The highest radionuclide cancer risks are associated with exposure to radium-226/228 in soil and inhalation of radon from shallow and deep bedrock groundwater. There is also a potential for adverse noncarcinogenic effects to potential future resident residing at Lucky Lass Mine that is associated solely with the ingestion of arsenic in deep bedrock groundwater (hazard index ranging from 2-9). [Deep bedrock groundwater throughout the Mines site, which is unimpacted by historical mining activities, contains levels of naturally occurring arsenic, radon, and minerals that should prelude its use a residential drinking water source. Risks associated with exposure to shallow bedrock groundwater at the White King protore stockpile are dominated by a single well located in an area of possible natural mineralization that is not impacted by the overlying stockpile. For a variety of reasons, use of the shallow aquifer for drinking water purposes in the vicinity of the site seems unlikely. Therefore, this exposure pathway very likely over estimates the potential risks.

Ecological Risks

The purpose of the baseline ecological risk assessment was to evaluate the potential for effects on the natural environment of site-related contamination in soils, surface water, and sediment. Ecological risks are estimated by calculating a hazard quotient (HQ). A HQ greater than one indicates a potential risk of adverse chronic effects resulting from exposure. Unlike the Human Health Risk Assessment, the Ecological Risk Assessment focuses on the effects to population or communities, not individuals. If potential risks to individuals of a species are identified during the Ecological Risk Assessment, they are evaluated within a larger context to determine the ecological significance. The findings of the ecological risk assessment are as follows:

- The primary site-related contaminants of concern for plants, wildlife and aquatic life are Arsenic, Mercury, Antimony, Aluminum, Selenium, and Iron. No adverse impact to ecological receptors is predicted from the Radionuclides found in surface soil, subsurface soil, sediment, and surface water at the Mines site.

- Some adverse impact, was predicted for the blue grouse, vagrant shrew, and terrestrial plants exposed to non-Radionuclides (hazard index ranging from 38 to 94,000) primarily from arsenic, selenium, and mercury in surface and subsurface soil at the White King Mine.

- Adverse impact, was also predicted for aquatic invertebrates exposed to nonradionuclide contaminants (Arsenic, Mercury, Manganese, and Copper) in sediment of the White King pond, Lucky Lass pond, and Augur Creek (hazard index ranges

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund human health risk assessment estimates the "baseline risk". This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate the baseline risk at Superfund site, EPA undertakes a four-step process:

Step 1: Analyze Contamination
Step 2 Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies helps EPA to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, EPA considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, EPA calculates a "reasonable maximum exposure " (RME) scenario, which portrays the highest level of human exposure that could reasonable be expected to occur.

In Step 3, EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential cancer risk. The likelihood of any kind of cancer resulting from a Superfund site is generally expressed as an upper bound probability, for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, EPA calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

In Step 4, EPA determines whether site risks are great enough to cause health problems for people at or near the Superfund site. The result of the three previous steps are combined, evaluated and summarized. EPA adds up the potential risks from the individual contaminants and exposure pathways and calculates a total site risk.

from 9-45).

Action is necessary to protect the public health or the environment from the risks described above, associated with actual or threatened releases of hazardous substances into the environment. The preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) provide a general description of what the cleanup will accomplish. The RAOs for this site are to:

- Prevent the release and migration of arsenic and radium-226 from stockpiles to the groundwater and surface waters to ensure the beneficial use of these resources;
- Prevent the direct contact threat associated with arsenic and radium-226 in contaminated soil and stockpiles;
- Reduce or eliminate the threat from external radiation associated with contaminated soil.
- Prevent removal or use of stockpiles or contaminated soils such as residential fill or building materials.
- Reduce the acidity and maintain a neutral pH in the White King Pond water in order to support an ecological habitat and be protective of potential human uses.

The proposed action will reduce the excess cancer risk associated with exposure to soils. This will be achieved by capping soils and eliminating direct contact to contaminated soils above the following proposed cleanup levels:

<u>Soil at White King</u>
Arsenic 442 mg/kg
Radium-226 6.8 pCi/g

<u>Soil at Lucky Lass</u>
Arsenic 38 mg/kg
Radium-226 3.6 pCi/g

The proposed action will reduce the potential for migration of contaminants into surface water and sediment of Augur Creek. Monitoring of Augur Creek for any exceedances of the following target levels[3] will determine if the target levels are being met. If these levels are not met additional action may be necessary in order to control contaminant migration.

<u>Augur Creek Surface Water</u>
Arsenic .033 mg/l (Recreation)

<u>Augur Creek Sediment</u>
Arsenic 16 mg/kg (Recreation)
6 mg/kg (Ecological)
Manganese 1610 mg/kg(Ecological)

The proposed action will also enable the White King Pond to support an ecological habitat and be protective of human use through neutralization and monitoring. Maintenance of a stable PH, without severe fluctuations, will be required to meet this goal. The following targets have been established to ensure these goals are being met:

<u>White King Pond Surface Water</u>
Arsenic 0.036 mg/l (Recreation)
Aluminum 200 Fg/l (Ecological)
pH 6.5 -9

<u>White King Sediment</u>
Arsenic 6 mg/kg (Ecological)
Manganese 1610 mg/kg (Ecological)

EPA established the above targets, or Preliminary Remediation Goals (PRGs)[4], based on background values or State of Oregon Soil Cleanup Rules (ORS 465.315), whichever was higher. Action is proposed whenever concentrations exceed these goals.

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3 All water concentrations are based on total analysis

4 Based on consideration of factors during the nine criteria analysis and using the PRG as a point of departure, the final cleanup level may reflect a different risk level with the acceptable range (10^{-4} to 10^{-6} for carcinogens) than the originally identified PRG.

SUMMARY AND EVALUATION OF ALTERNATIVES

Many technologies were considered for use in cleaning up the White King/Lucky Lass site. The preferred alternatives for the White King/Lucky Lass site were selected on the basis of the nine remedial alternative evaluation criteria found in the NCP and shown in Table 1. The nine criteria are divided into three categories: threshold, balancing, and modifying criteria. To be eligible for selection, an alternative must meet the two threshold criteria (Overall protection of human health and the environment and compliance with Applicable or Relevant and Appropriate Requirements (ARARs)). The five balancing criteria weigh tradeoffs among alternatives; A low rating on one balancing criterion can be compensated by a high rating on another. The two modifying criteria are generally considered after the public comment period during selection of the final remedy. However, if EPA is aware of state or community preferences with respect to an alternative, this information will be considered during development of the proposed plan. The remedial alternatives for the site are presented below and summarized in Table 2. The costs for all alternatives[5] are listed under each alternative and compared in Table 3. The alternatives are numbered to correspond with the numbers in the RI/FS Report.

Common Elements. Several of the remedies require institutional controls (e.g., deed restrictions such as an easement or covenant) to limit the use of portions of the site, to restrict residential use and ensure the integrity of the stockpile cap. These resource use restrictions are discussed in each alternative as appropriate. The type of restriction and enforceability will need to be determined for the selected remedy in the ROD. Land use restrictions could consist of access restrictions through Forest Service regulations, possibly in the form of Forest Plan amendments. Similar land use restrictions would be required on private lands when appropriate. The Forest Service may also permanently withdraw the Mine areas from any future mining activity. Monitoring to ensure the effectiveness of the remedy, including deed restrictions, are a component of each alternative except the "no-action" alternatives. The details of the land use restrictions and monitoring will be outlined in the ROD. Finally, due to the remoteness of the site none of the alternatives are expected to pose any short term impacts to the community near the site.

[5] All costs are estimates with an expected accuracy of +50% to -30%.

Table 1
Criteria for Evaluation of Alternatives.

THRESHOLD CRITERIA: Must be met by all alternatives

1. **Overall protection of human health and the environment.** How well does the alternative protect human health and environment, both during and after construction?

2. **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).** Does the alternative meet all applicable or relevant and appropriate state and federal laws?

BALANCING CRITERIA: Used to compare alternatives.

3. **Long-term effectiveness and permanence.** How well does the alternative protect human health and the environment after completion of cleanup? What, if any, risks will remain at the site?

4. **Reduction of toxicity, mobility, or volume through treatment or recycling.** Does the alternative effectively treat the contamination to significantly reduce the toxicity, mobility, and volume of the hazardous substances?

5. **Short-term effectiveness.** Are there potential adverse effect to either human health or the environment during construction or implementation of the alternative?

6. **Implementability.** Is the alternative both technically and administratively feasible? Has the technology been used successfully at similar sites?

7. **Cost** What are the relative costs of the alternative?

MODIFYING CRITERIA: Evaluated as a result of public comments.

8. **State acceptance.** What are the state's comments or concerns about the alternatives considered and about the preferred alternative? Does the state support or oppose the preferred alternative?

9. **Community acceptance.** What are the community's comments or concerns about the alternatives considered and the preferred alternative? Does the community generally support or oppose te preferred alternative?

WHITE KING STOCKPILES

Alternative SP-1: No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

Description. Under this alternative, no cleanup action of any type would be performed. The No Action Alternative would not meet the threshold criteria for protection of human health and the environment and compliance with ARARs and has been ruled out for further consideration.

Alternative SP-2: Institutional Controls and Monitoring

Estimated Capital Cost: $509,000
Estimated Annual O&M Cost: $36,000
Estimated Present Worth Cost: $956,000
Estimated Construction Timeframe: None
Description. This alternative consists of physical restrictions, land use restrictions, and monitoring. Land use restrictions such as deed restrictions would be put in place to prevent residential use of stockpile material and contaminated soil. As discussed above land use restrictions could consist of access restrictions through Forest Service regulations, possibly in the form of Forest Plan amendments. Similar land use restrictions would be required on private lands when appropriate. Fences would be placed around the stockpiles at White King and Lucky Lass to restrict human and animal access to the contaminated soils. Monitoring would include collection of groundwater, surface water, and creek sediments to ensure that contaminants are not migrating and beneficial uses of groundwater and surface water are maintained[6].

[6] ODEQ Rules (ORS 465.200-465.455 Division 122) define Beneficial uses of water as any current or reasonably likely future uses of groundwater or surface water by humans or ecological receptors. The current and likely future uses of groundwater and surface water at this site are for

Evaluation. Alternative SP-2 reduces the present and future human health risk through physical and land use restrictions, including fencing, restricted land use and restrictions on the use of stockpile materials. These institutional controls limit human access to stockpiled material and, hence, exposure. The level of protection for this alternative depends upon continued effectiveness of the institutional controls and their long-term maintenance and monitoring. Although Alternative SP-2 may limit exposure to the stockpiles, it may not meet all state and federal ARARs to protect human health and the environment. It also does not prevent biointrusion and ecological risk. Alternative SP-2 does not use any treatment process and there is no reduction in toxicity, mobility, or volume. Alternative SP-2 provides no long-term effectiveness against potential downgradient ground water effects. Institutional controls cannot address infiltration and percolation that result from leaving the stockpiles uncovered. For Alternative SP-2, the impacts to the community, workers and the environment during implementation are minimal because the remedy would involve only institutional controls and monitoring. Alternative SP-2 can be implemented to prevent access to the White King stockpiles and to limit land use.

Alternative SP-3a: In-Place Containment

Estimated Capital Cost: $4,316,000
Estimated Annual O&M Cost: $68,000
Estimated Present Worth Cost: $5,160,000
Estimated Construction Timeframe: 5.5 months

Description. Alternative SP-3a includes regrading the two White King stockpiles and placing a separate 12-inch soil cover over each stockpile[7].

Regrading would be conducted to provide slope stability, promote drainage, control erosion, minimize the area that requires final cover, and move the stockpiles away from Augur Creek. Under this alternative, approximately 250,000 cubic yards of the stockpiles would be regraded. One goal of the regrading is to use the existing clay in the stockpiles to provide a lower permeability layer below the soil cover. It is estimated that a 9 to 15-inch layer could be placed on the two stockpiles. After regrading and compacting, each stockpile would be covered with 9 inches of soil overlain by 3 inches of top soil and vegetation (cool season grasses). The final area to be capped is estimated to be 36 acres. After regrading, disturbed areas would be reclaimed with soil and vegetation. Engineering controls will be implemented to prevent erosion until the vegetative cover is established. Implementation of this remedy would include maintenance and monitoring to ensure the integrity of the two covers. Additional actions would include moving the piles at least 25 feet from Augur Creek and placing rip rap along the sides of the piles facing the creek. Institutional controls (land use, restriction and fencing), and monitoring components are the same as described in Alternative SP-2.

Evaluation. Alternative SP-3a can provide full protection of human health and the environment. However, OOE has interpreted its regulations such that this alternative would not meet their regulations under ORS 469 and the Energy Facility Siting Council Rules for the disposal of radioactive materials. SP-3a would allow levels of Ra-226 in the overburden stockpile, which are subject to OOE regulation, to remain in the floodplain where they would be in the direct path of the 500-year flood even if the overburden pile is moved back from Augur Creek. Under ORS 469 regulations disposal of radioactive materials above specific levels is prohibited in the floodplain of a creek or river. Therefore, this alternative would not meet all ARARs. The regrading of the stockpiles, soil cover, and fence reduce the risk of exposure to stockpile material by humans and to some extent ecological receptors and

agriculture purposes and use by ecological receptors.

[7] For alternatives that require a cap, a 12-inch soil cover was used in the FS for comparison purposes. This cap design is called Option A in the FS. This cap requires a higher level of maintenance than a thicker cap but can be equally protective if properly maintained on a regular basis. At the request of EPA and the support agencies, who did not feel that 12 inches of soil would provide an adequate cover, two other thicker cap designs (B and C) are presented in an Addendum to the FS. Cover Option B includes the 12 inch soil cover with 6 inches of biointrusion rock. Cover Option C includes 12 inches of rock at the surface, 24 inch frost protection layer, 12 inches of biointrusion rock and 18" of a clay/soil radon barrier.

reduce potential leaching, erosion or runoff of contaminants. The soil cover would be used as additional assurance that infiltration does not result in degradation of groundwater quality and would also reduce gamma emissions. Control of biointrusion would require a chain link type fence of small enough mesh to restrict burrowing animals and herbivores. Alternative SP-3a does not use any treatment process. Alternative SP-3a would impact the nearby roads because of additional traffic to haul soil cover material from an off-site source. There is a potential chemical and radiological risk to workers or other site visitors through inhalation and direct contact during grading of stockpile material. There is a potential risk of impacting Augur Creek through runoff during construction. Alternative SP-3a is relatively easy to implement using conventional construction equipment.

Alternative SP-3b:Containment and Consolidation at Protore Stockpile Location º ***(EPA and Forest Service Preferred Alternative)***

Estimated Capital Cost: $6,249,000 + cost for biointrusion layer (see footnote on Table 3).
Estimated Annual O&M Cost: $54,000
Estimated Present Worth Cost: $6,919,000 + biointrusion cost
Estimated Construction Timeframe: two 5.5-month construction seasons

<u>Description</u>. Alternative SP-3b involves excavation and placement of the overburden stockpile at the White King mine onto the protore stockpile at White King. Approximately 465,000 cubic yards of overburden would be moved and regraded. The total area that would require cover material would be approximately 25 acres. The relocated material would be placed over the existing protore stockpile and an additional 4.5 acres of up slope undisturbed land. Approximately 7.5 feet of compacted clay from the overburden stockpile would be placed on the top of the final consolidated stockpile. The 12-inch soil cover described under Alternative SP-3a would be placed over the compacted clay. [*EPA & the Forest Service preferred alternative differs from alternative SP-3b as described in the FS by the addition of a 12-inch thick biointrusion layer below the soil cover. This additional layer would limit growth of tap root plants such as trees and limit impacts from burrowing animals. Use of a biointrusion layer would require only a field fence to restrict herbivores from the capped area. This additional layer will add approximately $560,000 to the cost of this alternative. An equivalent or even a greater increase (due to the larger surface area) in costs should be added to Alternative SP-3a in order to make an accurate cost comparison between the two alternatives*]. After excavation, disturbed areas would be reclaimed with soil and vegetation. Implementation of this remedy would include maintenance and monitoring to ensure cover integrity. Institutional controls (land use, restriction and field fence), and monitoring components are the same as described in Alternative SP-2.

<u>Evaluation</u>. A major objective of this alternative is to remove overburden containing Ra-226 from the floodplain of Augur Creek in order to meet state Office of Energy regulations described above and reduce erosion. This alternative would also move portions of the protore stockpile, which contain Ra-226, away from Augur Creek and out of the floodplain into a more stable condition. In addition, compared with the other alternatives this one provides the maximum thickness of clay-like material (7.6-feet) over the top of the stockpile which would reduce infiltration, radon emanation, gamma emissions and isolate the most contaminated material from erosion or direct contact. The additional 12 inches of rock would provide an effective barrier against biointrusion and human contact reducing the human and ecological risks predicted for this site. With the biointrusion layer only a field fence will be required to restrict herbivores. Overall alternative SP-3b provides full protection of human health and the environment and meets all ARARs. Alternative SP-3b does not use any treatment process and there is no reduction in toxicity. Alternative SP-3b would require somewhat less maintenance on 25 acres of cap compared to the 36 acres for Alternative SP-3a. The 7.5 feet recompacted clay in this alternative would be more effective in the long-term if there was a lapse in cap maintenance, and

therefore more permanent. The short-term effectiveness of Alternative SP-3b would be slightly greater than Alternative SP-3a, because of the smaller area required for the cap. There is a potential risk for workers due to excavation and movement of 480,000 cubic yards of stockpile material. There is also a potential risk due to inhalation and direct contact with the material. Similar to Alternative SP-3a, Alternatives SP-3b is also implementable with standard construction equipment.

Alternative SP-4a: Consolidation & Containment of the White King Stockpiles within the White King Mine Pit.

Estimated Capital Cost: $10,828,000
Estimated Annual O&M Cost: $55,000
Estimated Present Worth Cost: $11,510,000
Estimated Construction Timeframe: two 5.5-month construction seasons

Description. Alternative SP-4a involves excavating the White King stockpiles, dewatering the White King pond, and placing the stockpile material within the empty pond. During filling of the pit, clay-like material would be placed at the bottom, along the highwalls, and at the top of the

Table 2
SUMMARY OF REMEDIAL ALTERNATIVES
WHITE KING/LUCKY LASS SITE

Area of Site	RI/FS Designation	Description
White King Stockpiles	SP-1	No Action
	SP-2	Institutional Controls and Monitoring
	SP-3a	In-place Containment
	SP-3b	Containment/Consolidation at Protore Stockpile
	SP-4a	Containment within the White King Mine Pit
	SP-4d	Containment within White King Pit with Treatment Wall
	SP-5	Containment in an "Off-Mine" cell
White King Pond Water	WKPW-1	No Action
	WKPW-2	Institutional Controls and Monitoring
	WKPW-3	In - Situ Neutralization of Pond
	WKPW-4	Land Application of Untreated Pond Water
	WKPW-5a	Land Application of In Situ Treated Pond Water
	WKPW-5b	Surface Discharge of In Situ Treated Pond Water
	WKPW-6a	Land Application of Ex Situ Treated Pond Water

	WKPW-6b	Surface Discharge of Ex Situ Treated Pond Water
Lucky Lass Stockpiles	LL-1	No Action
	LL-2	Institutional Controls
	LL-3	Removal and Containment of Soil with White King Stockpiles
	LL-4	"Off-Mine" Disposal

regraded material. It is estimated that five feet of clay would underlay the 12-inch soil cover. Approximately 980,000 cubic yards of material would be placed into the mine pit. After excavation, disturbed areas would be reclaimed with soil and vegetation. Implementation of this remedy would include maintenance and monitoring to ensure the integrity of the cover. Institutional controls (land use, restriction and fencing), and monitoring components are the same as described in Alternative SP-2.

Evaluation. Alternative SP-4a provides full protection of human health and the environment. Because portions of the White King pond may be in the historic floodplain of Augur Creek, direct placement of overburden into the White King Pond may not comply with OOE regulations for disposal of radioactive material. However, if stockpile material with regulated levels of Ra-226 were placed above the historic floodplain of Augur Creek this alternative would comply with all ARARs. This alternative would reduce or eliminate potential acid rock drainage(ARD)[8] generation and impacts to groundwater for those materials below the water table in the White King Mine pond by eliminating contact with air. Alternative SP-4a provides a reduction of potential radon emanation, gamma emissions, infiltration and biointrusion. Alternative SP-4a also provides a reduction in the total volume of percolation through the excavated stockpile of 98 percent as compared to Alternative SP-2. Alternative SP-4a does not use any treatment process and there is no reduction in toxicity. This alternative isolates the most contaminated material underground and provides a high level of long-term effectiveness and permanence, even in the absence of continued cap maintenance. (It should be noted that the OOE has raised issues concerning the long-term effectiveness of SP-4a. These issues concern the potential for acid drainage and hydraulic instability. The EPA and the Forest Service believe that these issues may not be resolved to OOE's satisfaction even after additional study and analysis.) Alternative SP-4a poses a potential risk to workers or other site visitors because it involves moving 980,000 cubic yards of stockpile material into the White King pit. Alternatives SP-4a can be implemented using standard construction practices. A variety of techniques for moving the large volume of material could be utilized which could represent significant cost savings over those estimated in the Feasibility Study.

Alternative SP-4d: Consolidation & Containment of Material in Pond with a permeable treatment wall.

Estimated Capital Cost: $11,314,000
Estimated Annual O&M Cost: $55,000
Estimated Present Worth Cost: $11,996.000
Estimated Construction Timeframe: two 5.5-month construction seasons

Description. The components of this alternative are the same as Alternative SP-4a, except that a permeable limestone layer would also be used in the pit in the direction of groundwater flow. The purpose of the treatment wall is to neutralize any acid rock drainage that potentially could be generated from either the stockpile material or the pit walls which could impact groundwater.

Evaluation. Alternative SP-4d is somewhat similar to Alternative SP-4a regarding the level of protection and compliance with ARARs. The addition of a permeable limestone wall would neutralize any potential acidic water generated in the pit

[8] ARD is the product formed by the atmospheric (i.e. by water, oxygen and carbon dioxide) oxidation of the relatively common iron-sulphur minerals pyrite and pyrrhotite in the presence of (catalyzed by) bacteria, and any other products generated as a consequence of these oxidation reactions.

and prevent any impacts to groundwater. The long-term effectiveness of Alternative SP-4d is similar to Alternative SP-4a, although the permeable limestone wall reduces the residual risk of migration of acidity into groundwater still further. Alternative SP-4d does not use any treatment process per se but the limestone would help to neutralize acidity. The short-term effectiveness is similar to SP-4a. The implementability of Alternative SP-4d would be similar to Alternative SP-4a with the exception that 3,000 cu. yd. of pulverized limestone would be required to construct the treatment wall. Total costs are $11,996,000.

Alternative SP-5: Excavation of stockpiles and disposal in a new "Off-Mine" disposal area.

Estimated Capital Cost: $26,116,000
Estimated Annual O&M Cost: $61,300
Estimated Present Worth Cost: $26,840,000
Estimated Construction Timeframe: three 5.5-month construction seasons

Description. This alternative includes dewatering the White King pond, construction of an engineered disposal cell located away from the mined area, placement of the excavated material from construction of the cell into the White King Mine pit, excavation and placement of stockpiles into the disposal cell, and restoration of the stockpile areas with topsoil. The cell would be constructed in a location above any influences of groundwater but below the ground surface. A compacted clay layer would be placed on the bottom of the cell and the cover would be a 12- inch soil as described in SP-3a. The tentative location of the new cell would be northwest of the site on National Forest System Lands. Implementation of this remedy would include maintenance and monitoring to ensure cover integrity. Institutional controls (land use, restriction and fencing), and monitoring components are the same as described in Alternative SP-2.

Evaluation. Alternative SP-5 provides full protection of human health and the environment and addresses most ARARs. However, this alternative is not consistent with the Fremont National Forest Land and Resource Management Plan. Since most of the stockpile material would be placed below the surface, human or animal exposure would be greatly reduced for the long term. A cover for the new off-site disposal cell would provide the same level of protection as the covers used in discussing Alternative SP-4a or 4d. Alternative SP-5 is very effective in the long-term for protection of human health from exposure to the surface of the existing uncovered piles - this exposure would be eliminated. This alternative would not involve any treatment or reduction in toxicity. The engineered cover would help to reduce the mobility of contaminants as a result of infiltration of water and reduce radon emanation, gamma emissions, and biointrusion. Alternative SP-5 poses a greater potential risk to workers and onsite visitors than do other alternatives because it involves excavation, moving, and exposure to twice the volume of material. For Alternative SP-5, excavation and moving the stockpiles is technically feasible with conventional construction equipment, but additional expertise may be needed for blasting the basalt for construction of the cell.

WHITE KING POND WATER ALTERNATIVES

The alternatives considered for the water-filled excavation pit located in the White King Mine area include leaving the pond water in place, or pumping and discharging the pond water. The alternatives considered in-situ treatment, ex-situ treatment, or no treatment. Selection of an alternative for the pond water is interrelated to the selected alternative for addressing the White King stockpiles. With the exception of WKPW-1 and WKPW-2, all alternatives provide long-term effectiveness and permanence.

Alternative WKPW-1. No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

Description. This alternative is used for comparison to other alternatives and does not include any type of action. No additional cost would be associated with this alternative. This alternative addresses the pond after it was neutralized in August 1998.

Evaluation. This alternative would not be protective of human health and the environment without some access restrictions and/or continued neutralization of the White King pond. It would also not meet applicable regulatory requirements. Therefore, it has been ruled out from further consideration.

Alternative WKPW-2. Institutional Controls and Monitoring

Estimated Capital Cost: $237,000
Estimated Annual O&M Cost: $24,000
Estimated Present Worth Cost: $535,000
Estimated Construction Timeframe: none

Description. This alternative consists of physical restrictions (fence and warning signs), land use restrictions through institutional controls, and groundwater and pond water monitoring. Land use restrictions could consist of access restrictions through Forest Service regulations, possibly in the form of Forest Plan amendments. Similar land use restrictions would be required on private lands when appropriate. The purpose of the monitoring is to ensure that there is no unacceptable risk from contaminant migration from the pond or surface waters of the pond.

Evaluation. The protectiveness and long-term effectiveness of this alternative depend on continuation of land-use controls. This alternative may not meet all ARARs since the National Contingency Plan (NCP) requires active response measures if determined to be practicable. It has already been demonstrated that the pond can be neutralized with a minimal level of effort and expense. WKPW-2 does not use any active treatment process as a principal element. Like Alternative WKPW-1, Alternative WKPW-2 is effective in the short-term because of low potential of risk to the community, workers, and environment during implementation. Alternative WKPW-2 can be easily implemented to prevent access to the White King pond water and to limit land use.

Alternative WKPW-3: Management of Pond Water Using Continued In-Situ Neutralization º (*EPA & Forest Service Preferred Alternative*)

Estimated Capital Cost: $237,000
Estimated Annual O&M Cost: $61,000
Estimated Present Worth Cost: $994,000
Estimated Construction Timeframe: ongoing

Description. This alternative includes the same monitoring requirements of WKPW-2 and continued in-situ treatment of the pond water to maintain a neutral pH level. Neutralization of the pond involves periodic addition of limestone or hydrated lime and monitoring to maintain near neutral pH conditions.

Evaluation. Alternative WKPW-3 fully protects human health and the environment and complies with ARARs. Human and ecological risks from the pond water would be eliminated because the pond would have a neutral pH. Existing sediments containing contaminants may eventually be covered by organic material created by increased biological activity. Long-term management of pond water will be needed to maintain long-term effectiveness; however, periodic neutralization is a process that is generally understood and reliable. Treatment of the pond water with hydrated lime or other materials will reduce the toxicity of the pond water. However, the process of neutralization has resulted in increased levels of arsenic and other contaminants in pond sediments, which may pose some risk to aquatic organisms. The concentrations of these contaminants and potential risks will need to be evaluated to ensure that this alternative is protective. If sediments pose a risk to the environment action will be required to remove or cap the contaminated sediments. Under this alternative, there is potential short-term risk to workers from handling and applying hydrated lime or other chemicals. Alternative WKPW-3 can be easily implemented and has been previously implemented on a pilot basis.

Alternative WKPW-4: Land Application of Pond Water without additional In-situ treatment

Estimated Capital Cost: $1,624,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $1,624,000

Estimated Construction Timeframe: 60 days

Description. Under this alternative, water would be pumped from the White King Pond and sprayed on the land within the immediate vicinity of the site. The area needed for land application is estimated to be approximately 300 acres.

Evaluation. Alternative WKPW-4 protects human health and the environment and complies with ARARs. Alternative WKPW-4 would require dewatering of the pond. After dewatering, the pit will be backfilled (with either clean fill or stockpiled material depending on which stockpile alternative is selected)and there will be no human residual risk in the pond, no potential for future exposure from the pond water, and no concerns for long-term reliability. WKPW-4 does not use any active treatment process as a principal element. For Alternative WKPW-4, there is potential risk to workers through direct contact with low pH water if the pond reacidifies before land application, and from physical hazards associated with routine construction activities during dewatering and land application. Alternatives WKPW-4, 5a, and 6a can each be implemented to dewater the White King pond and apply the water to the land.

Alternative WKPW-5a: Land Application of Pond Water after Additional In-Situ Treatment.

Estimated Capital Cost: $1,664,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $1,664,000
Estimated Construction Timeframe: 60 days

Description. Alternative WKPW-5a includes conducting in situ neutralization of the White King Pond water, pumping the neutralized White King Pond water, and then land applying the water over an area in the immediate vicinity of the site as discussed in WKPW-4. After dewatering, the pit will be backfilled with either clean fill or stockpiled material depending on which stockpile alternative is selected.

Evaluation. Alternative WKPW-5a protects human health and the environment and complies with ARARs. The long-term effectiveness of this alternative is the same as alternative WKPW-4. Alternatives WKPW-5a and WKPW-5b involve in situ neutralization with hydrated lime or other materials as the principal element for treating pond water, thereby reducing the toxicity of COCs in surface water. For Alternative WKPW-5a, there is potential risk to workers due to handling of hydrated lime slurry if the pond reacidifies, but there is reduced risk during land application as the water will have a neutral pH. Alternative WKPW-5a also has the potential risk to workers from physical hazards associated with routine construction activities during dewatering and land application.

Alternative WKPW-5b: Surface Water Discharge of Pond Water after Additional In-Situ Treatment

Estimated Capital Cost: $891,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $891,000
Estimated Construction Timeframe: 60 days

Description. This alternative includes conducting in situ treatment of the pond water and then discharging the water to Augur Creek. After dewatering, the pit will be backfilled with either clean fill or stockpiled material depending on which stockpile alternative is selected.

Evaluation. Alternative WKPW-5b protects human health and the environment and meets all ARARs. The long-term effectiveness of this alternative is the same as the previous alternatives. Alternative WKPW-5b involves *in situ* neutralization with hydrated lime or other materials as the principal element for treating pond water and thereby reducing the toxicity of contaminants in surface water. For Alternative WKPW-5b, there is potential risk to workers due to handling of hydrated lime slurry, and from physical hazards associated with routine construction activities during dewatering and installation of a discharge pipeline. The flow in Augur Creek during discharge is expected to be significantly lower than typically experienced during a spring snowmelt. The environmental impact is expected to be minimal because the discharge will have to meet state surface water discharge standards for Augur Creek

Alternatives WKPW-5b and 6b can each be implemented to dewater the White King pond and discharge the water to Augur Creek.

Alternative WKPW-6a: Land Application of Ex Situ Treated Pond Water.

Estimated Capital Cost: $1,731,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $1,731,000
Estimated Construction Timeframe: 60 days

Description. This alternative includes pumping the White King Pond Water, conducting ex-situ treatment of the water, and then land applying the water in the immediate vicinity of the site. Ex-situ treatment would consist of raising the pH of the pond to 7 or 8 by adding sodium hydroxide. A total of 21 tons of sodium hydroxide would be required to neutralize the acidity. After dewatering, the pit will be backfilled with either clean fill or stockpiled material depending on which stockpile alternative is selected.

Evaluation. Alternative WKPW-6a protects human health and the environment and meets all ARARs. Alternative WKPW-6a involves *ex-situ* neutralization with sodium hydroxide and sand filtration as the principal element for treating pond water to reduce toxicity of contaminants. The short-term effectiveness of Alternative WKPW-6a is similar to that of Alternative WKPW-5a.

Alternative WKPW-6b: Surface Water Discharge of Ex Situ Treated Pond Water

Estimated Capital Cost: $1,011,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $1,011,000
Estimated Construction Timeframe: 60 days

Description. This alternative is the same as WKPW-5b except that the treatment of pond water would take place ex situ.

Evaluation. Alternative WKPW-6b protects human health and the environment and meets all ARARs. Reduction of toxicity is achieved through neutralization. Alternative WKPW-6b is similar in short-term effectiveness to Alternative WKPW-5b, except that the neutralization in Alternatives WKPW-6a and WKPW-6b will be done *ex-situ*. There is a potential risk to workers due to handling of the sodium hydroxide instead of the hydrated lime. The capital/construction costs are $1,011,000. There are no long term costs associated with this alternative.

LUCKY LASS STOCKPILE

Alternative LL-1: No Action.

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0
Estimated Construction Timeframe: None

Description. Alternative LL-1 consists of no additional action.

Evaluation. Alternative LL-1 is not protective of human health and the environment because it involves no action. Therefore, it has been ruled out for further consideration.

Alternative LL-2: Institutional Controls

Estimated Capital Cost: $169,000
Estimated Annual O&M Cost: $15,000
Estimated Present Worth Cost: $355,000
Estimated Construction Timeframe: one month

Description. This alternative consists of physical and land use restrictions. Physical restriction would consist of a fence around those areas of the Lucky Lass Mine area where soils exceed protective levels for arsenic and radium-226. Exceedance of these levels is primarily found in the meadow adjacent to the stockpile and in small surface areas of the Lucky Lass Stockpile. Land use restrictions would consist of access

Table 3 White King/Lucky Lass Alternative Cost Comparison			
Alternative	**Capital Cost ($)**	**Annual Operation & Maintenance Cost ($)**	**Total 30-Year Present-Worth Cost ($)[1]**
White King Stockpiles[2]			
SP-1 No Action	$0	$0	$0
SP-2 Institutional Controls	$509,000	$36,000	$956,000
SP-3a In-Place Containment	$4,316,000	$68,000	$5,160,000
SP-3b Consolidation & Containment	$6,249,000	$54,000	$6,919,000
SP-4a In Pit Containment	$10,828,000	$55,000	$11,510,000
SP-4d In Pit with treatment wall	$11,314,000	$55,000	$11,996,000
SP-5 Off-Mine Disposal	$26,116,000	$61,300	$26,840,000
White King Pond Water			
WKPW-1 No Action	$0	$0	$0
WKPW-2 Institutional Controls/Monitoring	$237,000	$24,000	$535,000
WKPW-3 Pond Neutralization	$237,000	$61,000	$994,000
WKPW-5a Land Application of In Situ Treated Water	$1,624,000	$0	$1,624,000
WKPW-5b Surface Discharge of In Situ Treated Water	$891,000	$0	$891,000
WKPW-6a Land Application Ex Situ Treated Water	$1,731,000	$0	$1,731,000
WKPW-6b Surface Discharge of Ex Situ Treated Pond Water	$1,011,000	$0	$1,011,000
Luck Lass Stockpiles			
LL-1 No Action	$0	$0	$0
LL-2 Institutional Controls	$169,000	$15,000	$355,000
LL-3 Limited Soil Removal	$349,000	$15,000	$535,000
LL-4 Off-Mine Disposal (entire stockpile)	$2,656,000	$9,000	$2,768,000

All costs are estimates with an expected accuracy of +50% to -30%

[1]Total costs are based on present worth and include operation and maintenance for 30 years.
[2] For comparison purposes the costs for containment are based on cap design A which is 12 inches of soil without the biointrusion layer. With the addition of a biointrusion layer costs for both SP-3a and SP-3b would increase in proportion to the total area to be covered. It is estimated that a biointrusion layer on SP-3b would add approximately $560,000 to the capital cost.

restrictions through Forest Service regulations, possibly in the form of Forest Plan amendments, to prevent residential use and removal of the remaining stockpile material (under a residential use scenario the stockpile represents an unacceptable risk). The Forest Service may also permanently withdraw the Mine area from any future mining activity.

Evaluation. Alternative LL-2 relies on physical and land use restrictions to prevent exposure and/or use of materials at the site and is protective of human health.

However, some potential ecological risks would remain. This alternative would not meet all potential ARARs. Fence construction would result in minimal risks to workers, since the fence requires minimal intrusive work and the fence would be constructed outside the limits of the contaminated soil. Similarly, the impacts to the environment from Alternative LL-2 are expected to be minimal because of the nonintrusive nature of the remedy. Alternative LL-2 can be implemented to prevent access to the Lucky Lass Mine stockpiles and to limit land use.

Preventing access by constructing a barrier such as a fence and posting warning signs is technically feasible.

Alternative LL-3: Removal and Containment of Material Exceeding PRGs with the White King Mine Stockpile º *(EPA & Forest Service Preferred Alternative)*

Estimated Capital Cost: $349,000
Estimated Annual O&M Cost: $15,000
Estimated Present Worth Cost: $535,000
Estimated Construction Timeframe: one month

Description. This alternative involves excavating soils that exceed protective levels for arsenic and radium-226, restoration of the excavated area with topsoil, and reclamation of the Lucky Lass Stockpile. It is estimated that approximately 3,000 cubic yards of material would need to be excavated. The excavated material would be consolidated with the White King Stockpile. Reclamation of the Lucky Lass stockpile would include regrading to provide slope stability, promote drainage, and control erosion. Three inches of topsoil would be added as cover to promote vegetation. Land use restrictions, as described under LL-2, would be implemented if any soils remain above protective levels.

Evaluation. Alternative LL-3 protects human health and the environment and meets all ARARs. Alternative LL-3 is effective in the long term by eliminating the exposure to humans and ecological receptors to soils exceeding protective levels via removal and containment within or on the White King stockpile. As with Alternative LL-2, Alternative LL-3 would have no short-term risks to the community during implementation due to the remoteness of the site. Environmental impacts during the implementation of Alternative LL-3 would be similar to those associated with routine construction activities, including dust generation and stormwater management. Alternative LL-3 involves relatively small excavation and placement of material (3,000 cy) with the White King stockpile materials and would be relatively easy to implement. The services and materials are readily available. This alternative uses separation, removal, and co-disposal with overburden materials at the White King Site to reduce toxicity or mobility.

Alternative LL-4: "Off-Mine" Disposal

Estimated Capital Cost: $2,656,000
Estimated Annual O&M Cost: $9,000
Estimated Present Worth Cost: $2,768,000
Estimated Construction Timeframe: 5.5 months

Description. This alternative involves excavating the entire Lucky Lass Stockpiles (260,000 cubic yards) and the off-pile soils above protective levels (3,000 cubic yards) and placing them in an “off-mine” disposal cell. This alternative would be implemented in conjunction with White King alternative SP-5 (off-mine disposal). The excavated areas would then be restored with 3 inches of topsoil. Institutional controls and monitoring at the new disposal location are the same as described for SP-5. With removal of the stockpiles no institutional controls such as access restrictions or deed notices would be required at Lucky Lass.

Evaluation. Alternative LL-4 provides the greatest level of protection of human health and the environment for the Lucky Lass site. It also meets all ARARs for the site, but is not in accordance with the Fremont National Forest Land and Resource Management Plan. Alternative LL-4 also is effective in the long term by eliminating the exposure to humans and ecological receptors to all soils exceeding protective levels via removal and containment with the White King stockpiles. Potential impacts to human health and the environment could occur during the excavation of 260,000 cu.

yd. of Lucky Lass. Mine stockpile material. This potential impact would be mitigated using typical engineering controls such as dust suppressants and erosion control devices. Alternative LL-4 is technically feasible, and materials and services are available for the excavation and movement of the stockpile material (263,000 cu. yd.). As with the other Lucky Lass Alternatives, there is no treatment to reduce toxicity or mobility of contaminants.

SUMMARY OF THE PREFERRED ALTERNATIVE

The Preferred Alternative for the White King/Lucky Lass Site is a combination of containment & consolidation of White King Stockpile (SP-3b with a 12-inch rock biointrusion layer), continued Pond Water Neutralization (WKPW-4), and removal of soils exceeding PRGs in the Lucky Lass Stockpile and adjacent area and containment with the White King Stockpile (LL-3). The rationale for their selection is described below.

White King Stockpiles

The EPA, State, and Forest Service preferred alternative for the White King Overburden and Protore Stockpiles is to consolidate the two piles at the protore pile and cap the material[9] (Alternative SP-3b with the addition of a 12-inch rock biointrusion layer). This cover would require minimal maintenance and minimize plant and animal intrusion into the stockpile/cap material even if there was a lapse in annual maintenance. The pile will be moved at least 25 feet back from Augur Creek and rip rapped along the side of the creek and in areas subject to greater erosion.

This alternative would protect human health and the environment and comply with ARARs. It would have high long-term effectiveness and permanence, because it would isolate the most highly contaminated material beneath 7.5 feet of recompacted clay and 2 feet of soil/rock. Its short-term effectiveness would be moderate, because of the possibility for worker exposure during excavation and transport. It would not reduce toxicity through treatment, but would reduce mobility due to erosion due to the clay/soil cap. Implementability of this alternative would be high, because it uses standard construction materials and practices.

During the comparative analysis there were a number of alternatives that were relatively equal for many of the criteria. In-place containment was the lowest cost alternative which met the threshold criterion for protection of human health and the environment but it is the State’s position that this alternative may not meet state laws for disposal of radioactive material. EPA, the State, and the Forest Service prefer an alternative that combines the two stockpiles into one. The following are some of the reasons for this position:

1. Consolidation provides a more "engineered" final disposal area.

    The natural clays that are present in the overburden can be used to construct a clay cap of approximately 7.5 feet in thickness over the protore pile. This type of cap would further reduce contaminant migration either from erosion or infiltration, and provide adequate freeze thaw protection. The additional soil/biointrusion cap would promote vegetation and limit impacts from burrowing animals. Because more contaminated underlying material is isolated the potential for direct exposure and inadvertent human intrusion is reduced. During construction, the materials with the highest levels of contaminants could be placed above the existing protore pile, out of the Augur Creek floodplain, and below less contaminated material and the clay cap, thus further isolating this material from potential erosion and

[9] Deviation from this sequence of materials and respective material thicknesses is not anticipated; however, the engineered cover design may be refined during the remedial design.

direct contact. This alternative would provide a greater level of protection of human health and the environment, either in the absence of continued maintenance or reduced maintenance, than simply capping the materials in their current location. This alternative would also more closely compare to requirements for a cleanup at other sites where similar radioactive materials exist such as at Uranium Mill Tailings sites.

2. Consolidation would restore a greater portion of Augur Creek/Meadow wetland habitat to premining conditions than capping the stockpiles in-place.

Consolidation would return most of the Augur Creek meadow to premining conditions, including establishing 24 acres as a natural wetland. These environmental benefits would result without a significant increase in the footprint of the protore stockpile. Restoration of the meadow would have a positive effect on Augur Creek and the adjacent wetlands. This action would also meet EPA's responsibilities under Executive Order 11990 for Protection of Wetlands. Under this Order, EPA's actions should preserve and enhance the natural and beneficial values of wetlands.

3. Consolidation of the two stockpiles would provide a greater level of assurance that the remedy meets state regulations under Oregon Statutes (ORS 469) and Energy Facility Siting Council Rules. These rules prohibit disposal of radioactive waste in the floodplain of rivers, streams, or creeks.

The entire overburden stockpile is located within the floodplain of Augur Creek where it is subject to erosion from the direct path of Augur Creek. Based on the limited sampling data available on the overburden stockpile portions of this stockpile contain concentrations of Ra-226 which make it subject to regulation under OOEs regulations for disposal of radioactive material. OOE has determined that placement of this material on top of the protore stockpile would raise this material above the floodplain (and meet state siting regulations) and reduce the potential for erosion from Augur Creek. In addition during the process of consolidating the two stockpiles portions of the protore pile, which also contains Ra-226 subject to OOE regulations, would be moved away from the direct path of Augur Creek and out of the historic floodplain. This is a vast improvement over SP-3a where the entire overburden stockpile is in the direct path of the 500-year flood. While the recent amendments to OOE's rules are being challenged there are good technical reasons for selecting a remedy which meets the intent of the rules, i.e., to prevent erosion of the stockpiles.

4. Consolidation would reduce the total area to be capped as compared to Alternative SP-3a.

EPA, the State, and Forest Service believe that this is an important consideration in maintaining a cap. A cap in one location with a smaller surface area would allow easier long-term monitoring and repair and insure long term effectiveness. The long-term effectiveness and permanence required at the White King stockpiles is at least the decay time required to reduce external exposure risks to acceptable levels.

5. The state agencies both support alternative SP-3b with the biointrusion layer.

While state acceptance is considered a modifying criterion, EPA typically takes into consideration the state's position during development of the proposed plan. State acceptance of a remedial action is a significant factor in EPA's decision making process. Both the Oregon Office of Energy and the Oregon Department of Environmental Quality have indicated they support Alternative SP-3b with a biointrusion layer.

The estimated capital & construction cost of EPA's preferred alternative for the White King stockpiles is approximately $6,907,000 (+ approximately $560,000 for the biointrusion layer). This cost is significantly less than off-mine disposal ($26 million) or the in-pit disposal option ($11 million). Consolidation of the two stockpiles could be as much as $1.7 million more than in place capping. However, the cost differential between alternative SP-3a and SP-3b is small, relative to the total range of costs for all alternatives based on a 30-year present worth. Actual maintenance cost will extend beyond this as radioactive materials have long half-lives. As a result, maintenance costs past the 30-year period would reduce or eliminate any cost differential between alternatives SP-3a and SP-3b. EPA and the Forest Service believe that the additional initial cost of SP-3b over SP-3a is justified in order to ensure protection of human health and the environment over the long term and address state ARARs. It also may be insignificant compared to the costs of remediating a design failure over the long period of time that will be required to monitor this site.

Because there is little additional long-term effectiveness for the in-pit and off-mine disposal alternatives, the benefit does not justify the significantly greater costs. In addition there were a number of technical uncertainties on the potential groundwater impacts from the in-pit disposal option, which could not be easily resolved. The EPA and the Forest Service believe that these issues may not be resolved to OOE’s satisfaction even after additional study and analysis. These facts are additional reasons the federal agencies have not designated either of these alternatives as preferred.

White King Pond

The EPA and Forest Service preferred alternative for the pond is to keep it filled with water and use in-situ neutralization to maintain a consistent neutral pH (WKPW-3). Based upon the success of efforts in 1998 to neutralize the pond and 1999 data, it appears that neutralization can be an effective and relatively low cost option for raising the pH in the pond. However, it is unclear as to whether this technique can prevent fluctuation in the pH which could be detrimental to the development of aquatic organisms in the pond. If the pH can be held stable, the pond should become more biologically active. This would eventually minimize the neutralization frequency but it may not entirely eliminate the need for engineering controls. If the pond cannot be maintained at a neutral pH other actions to address the source of acidity or draining of the pond may be required. EPA will evaluate the success of neutralization on an annual basis and consider whether additional action is necessary within 5 years of implementation of the remedy.

All other alternatives that were evaluated in the FS for the pond were based on removing the water and filling the pond with either clean fill or stockpile material. The preferred alternative for the stockpiles will not return the stockpile material to the pit. Therefore, draining of the pond is not necessary to address the unacceptable risks.

Neutralization of pond water provides a higher degree of protection for human health and the environment than if institutional controls alone were selected. Elevated levels of arsenic in sediments will require some further monitoring and evaluation to ensure that this alternative is protective of the environment. The details of the monitoring will be developed during the remedial design and should address, at a minimum, the potential for bioaccumulation and toxic effects to invertebrates.

Lucky Lass Stockpile

The EPA and Forest Service preferred alternative for the Lucky Lass Stockpile is removal and containment of material exceeding protective levels for radium and arsenic and consolidation within the White King Mine Protore Stockpile (LL-3). Additional reclamation of the stockpile would occur to provide slope stability, promote drainage, and control erosion. With the removal of these soils at Lucky Lass, the remaining stockpile material can be managed by institutional controls, such as fencing and deed restrictions (The remaining stockpiles still represent some risk from direct exposure to soils under a residential exposure scenario). This alternative provides overall protection of human health and the environment as well as greater level of long-term effectiveness than just institutional controls. Based upon the overall site risks, it is not necessary to remove the stockpile material to an off-mine area.

Based on the information currently available, EPA and the Forest Service believe the Preferred Alternatives would meet the threshold criteria and provide the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The EPA and Forest Service expect the Preferred Alternative to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

COMMUNITY PARTICIPATION

EPA will consider comments received during the public comment period before choosing cleanup action for the site. EPA will respond to all comments on the Proposed Plan in the Responsiveness Summary which will be included in the ROD. The ROD will document the selection of the cleanup action for the site.

ADDITIONAL INFORMATION

Anyone interested in learning more about the site investigations or the Superfund process is encouraged to review materials at the Information Repositories maintained for the site. They contain copies of the RI Work Plan, the RI Report, the FS, the Risk Assessment, the Community Relations Plan, the Proposed Plan, and other materials related to the site. The Information Repositories are provided on the front page of this Proposed Plan.

An Administrative Record file, which contains the information upon which the selection of the cleanup remedy will be based, has also been established at EPA's Regional office in Seattle.

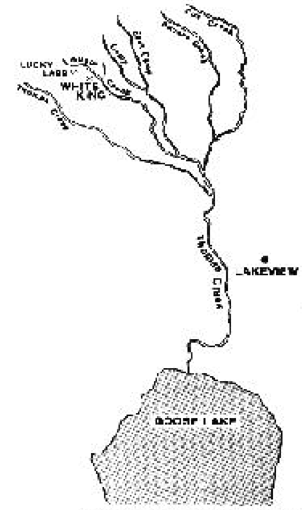
Questions?

For further information on the White King/Lucky Lass site, please contact:

Bill Adams, Project Manager
(206) 553-2806 or 1-800-424-4372, ext. 2806

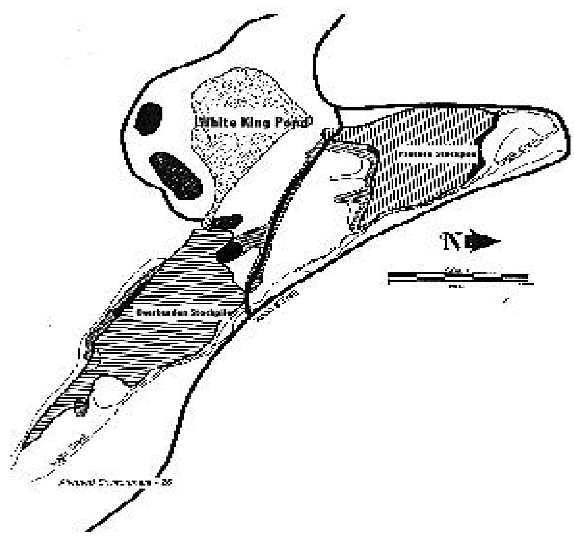
For those with impaired hearing or speech, please contact EPA’s telecommunications device for the hearing impaired (TDD) at (206) 553-1698. To ensure effective communications with everyone, additional services can be made available to persons with disabilities by contacting one of the numbers listed above.

Finally, if you have tried to understand or participate in this process and feel that the EPA Region 10 Superfund Program has not heard, listened to, or responded adequately to your concerns, you may wish to call and raise your concern with the independent Ombudsman for Region 10, Lauri Hennessey, at (206) 553-6638.

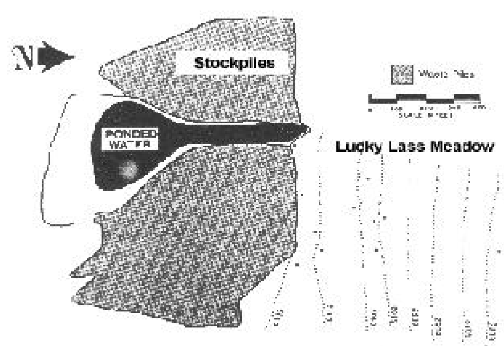


Portion of Goose Lake Subbasin Closed Drainage System

White King Mine Area



Lucky Lass Mine Area



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USE THIS SPACE TO WRITE YOUR COMMENTS

Your opinions on this Proposed Plan cleanup at the White King/Lucky Lass Superfund site are important to assist EPA in selecting a final remedy for the site.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked by October 31, 1999. If you have questions during the comment period, please contact Bill Adams at (206) 553-2806 or through EPA's toll-free number at 1-800-424-4372, ext. 2806. Those with electronic communications capabilities may submit their comments to EPA via Internet at the following e-mail address: adams.bill@epa.gov.

Name___________________________

Address____

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